

CLAIMS

1. An image-processing apparatus for quantizing multi-level (M-level) image data into N values, where $M > N > 1$,
5 using a multi-level error-diffusion process or a minimum-average multi-level error method, comprising:

means for outputting correction data in which an error diffused from already-quantized pixels therearound is added to the multi-level image data of a pixel in question;

10 means for setting a quantization-threshold value based on the multi-level image data of the pixel in question;

means for comparing the correction data and the quantization-threshold value so as to output N-level image data;

15 and means for calculating an error generated when generating the N-level image data;

wherein, assuming quantized values are 0, 1, 2, ..., N-1, and tones of the quantized values are $V_0, V_1, V_2, \dots, V_{N-1}$, respectively at least one threshold value Th_{a+1} in an interval
20 between V_a and V_{a+1} (where $0 \leq a < N-1$) of at least one input value, when an input tone value is v , is set based on equation (1), where the equation (1) is:

$$Th_{a+1} = (\sqrt{((v - V_a)(V_{a+1} - V_a)/2)}) + V_a.$$

25 2. The image-processing apparatus as claimed in

Claim 1, wherein the threshold value is set based on said equation (1) only when, in the input value interval between V_a and V_{a+1} (where $0 \leq a < N-1$), the input value v is greater than a constant K_a (where $V_a < K_a < V_{a+1}$).

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3. The image-processing apparatus as claimed in Claim 1, wherein the threshold value is obtained through a sequential process depending on the input value v .

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4. The image-processing apparatus as claimed in Claim 2, wherein the threshold value is obtained through a sequential process depending on the input value v .

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5. The image-processing apparatus as claimed in Claim 1, wherein the threshold value is obtained from a look-up table depending on the input value v .

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6. The image-processing apparatus as claimed in Claim 2, wherein the threshold value is obtained from a look-up table depending on the input value v .

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7. An image-forming apparatus for quantizing input multi-level (M -level) image data into N values, where $M > N > 1$, using a multi-level error-diffusion process or a minimum-average multi-level error method and forming an image

using dots which correspond to each of the N values,
comprising:

means for outputting correction data in which an
error diffused from already-quantized pixels therearound is
5 added to the multi-level image data of a pixel in question;

means for setting a quantization-threshold value
based on the multi-level image data of the pixel in question;

means for comparing the correction data and the
quantization-threshold value so as to output N-level image
10 data;

and means for calculating an error generated when
generating the N-level image data;

wherein, assuming quantized values are 0, 1, 2, ...,
N-1, and tones of the quantized values are V0, V1, V2, ..., VN-1,
15 respectively at least one threshold value Th_{a+1} in an interval
between V_a and V_{a+1} (where $0 \leq a < N-1$) of at least one input value,
when an input tone value is v , is set based on equation (1),
where the equation (1) is:

$$Th_{a+1} = (\sqrt{((v - V_a)(V_{a+1} - V_a)/2)}) + V_a.$$

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8. The image-forming apparatus as claimed in
Claim 7, wherein the threshold value is set based on said
equation (1) only when, in the input value interval between V_a
and V_{a+1} (where $0 \leq a < N-1$), the input value v is greater than a
25 constant K_a (where $V_a < K_a < V_{a+1}$).

9. The image-forming apparatus as claimed in Claim 7, wherein the threshold value is obtained through a sequential process depending on the input value v .

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10. The image-forming apparatus as claimed in Claim 8, wherein the threshold value is obtained through a sequential process depending on the input value v .

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11. The image-forming apparatus as claimed in Claim 7, wherein the threshold value is obtained from a look-up table depending on the input value v .

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12. The image-forming apparatus as claimed in Claim 8, wherein the threshold value is obtained from a look-up table depending on the input value v .

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13. The image-forming apparatus as claimed in Claim 7, wherein the image is formed with one of an electrophotographic method, an ink-jet method, and a thermal transfer method.

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14. The image-forming apparatus as claimed in Claim 8, wherein the image is formed with one of an electrophotographic method, an ink-jet method, and a thermal

transfer method.

15. The image-forming apparatus as claimed in Claim 9, wherein the image is formed with one of an
5 electrophotographic method, an ink-jet method, and a thermal transfer method.

16. The image-forming apparatus as claimed in Claim 10, wherein the image is formed with one of an
10 electrophotographic method, an ink-jet method, and a thermal transfer method.

17. The image-forming apparatus as claimed in Claim 11, wherein the image is formed with one of an
15 electrophotographic method, an ink-jet method, and a thermal transfer method.

18. The image-forming apparatus as claimed in Claim 12, wherein the image is formed with one of an
20 electrophotographic method, an ink-jet method, and a thermal transfer method.

19. A program for causing a computer to execute a process of quantizing multi-level (M-level) image data into N
25 values, where $M > N > 1$, using a multi-level error-diffusion

process or a minimum-average multi-level error method,
comprising:

a code for a step of outputting correction data in
which an error diffused from already-quantized pixels
5 therearound is added to the multi-level image data of a pixel
in question;

a code for a step of setting a quantization-
threshold value based on the multi-level image data of the
pixel in question;

10 a code for a step of comparing the correction data
and the quantization-threshold value so as to output N-level
image data;

and a code for a step of calculating an error
generated when generating the N-level image data,

15 wherein, assuming quantized values are 0, 1, 2, ...,
N-1, and tones of the quantized values are $V_0, V_1, V_2, \dots, V_{N-1}$,
respectively at least one threshold value Th_{a+1} in an interval
between V_a and V_{a+1} (where $0 \leq a < N-1$) of at least one input value,
when an input tone value is set to be v , is set based on
20 equation (1), where the equation (1) is:

$$Th_{a+1} = (\sqrt{((v - V_a)(V_{a+1} - V_a)/2)}) + V_a.$$

20. The program as claimed in Claim 19, wherein
the threshold value is set based on said equation (1) only
25 when, in the input value interval between V_a and V_{a+1} (where

$0 \leq a < N-1$), the input value v is greater than a constant K_a
(where $V_a < K_a < V_{a+1}$).